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Triodontolepis torrentis sp. n. (Cestoda: Hymenolepididae) a parasite of Neomys fodiens (Insectivora)*

By

É. MURAI

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ABSTRACT. A new cestode species, Triodontolepis torrentis sp. n. (Hymenolepididae) is described from water shrews, Neomys fodiens (Pennant, 1771) inhabiting various mountains of the Carpathian Basin. Faunistical data of T. bifurca (Hamann, 1891), T. hamanni (Mrázek, 1891) and T. skrjabini Spassky et Andrejko, 1968, as well as an identification key to the genus Triodontolepis Yamaguti, 1959 are given.

KEY WORDS: Triodontolepis torrentis sp. n. (Cestoda: Hymenolepididae), T. bifurca, T. hamanni, T. skrjabini, morphology, faunistics, hosts: Neomys fodiens and N. anomalus, habitat: Mountains of the Carpathian Basin.

YAMAGUTI (1959) erected the genus Triodontolepis to accommodate species of the Hymenolepididae with bifurcate guard. SPASSKY and ANDREJKO (1968) accepted the new genus and added a new species as Triodontolepis skrjabini. PROKOPIČ and MATSABERIDZE (1971) described the species T. kurashvilii, PROKOPIČ (1972) described T. ryšavýi and amended the description of the genus and relegated further species to be included. I have found four species of cestodes in the collection of the Hungarian Natural History Museum in Budapest which should be included in the genus Triodontolepis Yamaguti, 1959: T. bifurca (Hamann, 1891), T. hamanni (Mrázek, 1891), T. skrjabini Spassky et Andrejko, 1968 and a species new to science, T. torrentis sp. n. This paper contains morphological and faunistical description of these species and notes on the species composition of the genus.

MATERIALS AND METHODS

A large number of Neomys specimens from the Carpathian Basin were examined for their parasites between 1970 and 1984. During our joint project (between the Institute of Experimental Biology and Ecology of the Slovak Academy of Sciences and the Hungarian Natural History Museum) were trapped over 60 specimens of Neomys fodiens Pennant, 1771 and 30 specimens of N. anomalus Mottaz, 1907 in the western Carpathians. Sixty specimens of Neomys from the mountains of northern Hungary, the Bükk National Park and some localities in western Hungary have been dissected for internal parasites. In 1971 F. MÉSZÁROS collected in the Retezat and Gilau Mts (Southern Carpathians) of Roumania for the SENKENBERG Museum (Frankfurt am Main) and obtained cestodes from 35 Neomys fodiens.

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The hosts were collected by trapping and were usually dissected on the day on capture, the cestodes were fixed in hot physiological saline solution of 5 % formaldehyde. On some occasions the parasites were fixed by injecting the solution into the intestine, on other occasions the host specimens were deep-frozen and transported to the laboratory for subsequent dissection and preparation. The cestodes were stained with alun-carmine, hydrochloric acid carmine or Erlich's hematoxyline. (For deep-frozen specimens only the last staining method proved to be applicable.) The rostellar hooks were examined and preserved in Berlese solution. The scoleces were measured before preparation, the strobili and their scoleces have been given identification codes (letter or fraction, see list of type preparations). Half of the preparations are whole mounts.

DESCRIPTIONS AND FAUNISTICAL DATA OF TRIODONTOLEPIS SPECIES EXAMINED

Triodontolepis torrentis sp. n. (Figs 1-5 and 22-28).

Syn.: Hymenolepis montana Murai, 1984 (in MURAI and MÉSZÁROS, 1984, in litteris name), H. neomydis Baer, 1931 (in MURAI, MÉSZÁROS and STOLLMAN, 1983, taxonomic error).

Host: Neomys fodiens Pennant. - Localization: small intestine (in the second part). - Intensity: 2-20 specimens. - Extensity: 30 %. 118 T. torrentis specimens from 29 N. fodiens in 12 localities were captured.

Type material of Triodontolepis torrentis sp. n.

HOLOTYPE: Slovakia, Nizke Tatry Mts., Partizánska Lupča, Lupčianska dolina, Na Tajchu, 11 September, 1980, leg. F. MÉSZÁROS, whole mount preparation, HNHM No: 1914/16827/1.*

PARATYPES (all HNHM Nos):

Slovakia, Nizke Tatry Mts, Lupčianska dolina, Na Tajchu, 11 September 1980, leg. MÉSZÁROS, 6 specimens, Nos: 1914/16827/2, 1914/16827/3, 1914/16827/4, 1914/16827/5, 1914/16827/6, 1914/16827/7; Nizke Tatry Mts, Partizánska Lupča, Oružna dolina, 27 May, 1981, leg. MÉSZÁROS, 1 specimen, No: 2274/20102/1;

Vel'ká Fatra Mts, Lubochnianska dolina, 14 August, 1980, leg. MURAI, 7 specimens, Nos: 2002/16312/1, 2002/16312/2, 2002/16312/3, 2002/16312/4, 2002/16312/5, 2002/16312/6a-b, in the Cestode Collection of the Hungarian Natural History Museum, Budapest, and 2002/16312/7, deposited in Natural History Museum, Geneva (NHMG); Vel'ka Fatra Mts, Harmanec, Bystrická dolina, 30 August, 1979, leg. DUDICH, 2 specimens, Nos: 1300/13268/J1-2, 1300/13268/F1-2; Bystrická dolina, 28 August, 1979, leg. DUDICH, 2 specimens, Nos: 1529/13226/A1-2, 1529/13226/B; Bystrická dolina, 28 August, 1979, leg. DUDICH, 5 specimens, Nos: 1530/13330/1, 1530/13225/2 (two whole mount preparations), 1530/13330/A, 1530/13330/B, 1530/1330/C (scoleces in Berlese solution); Bystrická dolina, 28 August, 1979, leg. DUDICH, 5 specimens, Nos: 1549/13225/1a-b, 1549/13225/6, 1549/13225/14, 1549/13225/18, 1549/13225/19;

Nizke Beskydy Mts, Becherov, 13 September, 1979, leg. DUDICH and MURAI, 5 whole mount preparations and 1 scolex, Nos: 1030/13470/3, 1030/13470/4, 1030/13470/5a-b, 1030/13470/7, 1030/13470/8;

Čergov Mts, Lenartov, Večný potok, 10 November, 1981, leg. MÉSZÁROS and MURAI, 4 scoleces and 6 whole mount preparations, Nos: 2684/23047/A, 2684/23047/B, 2684/

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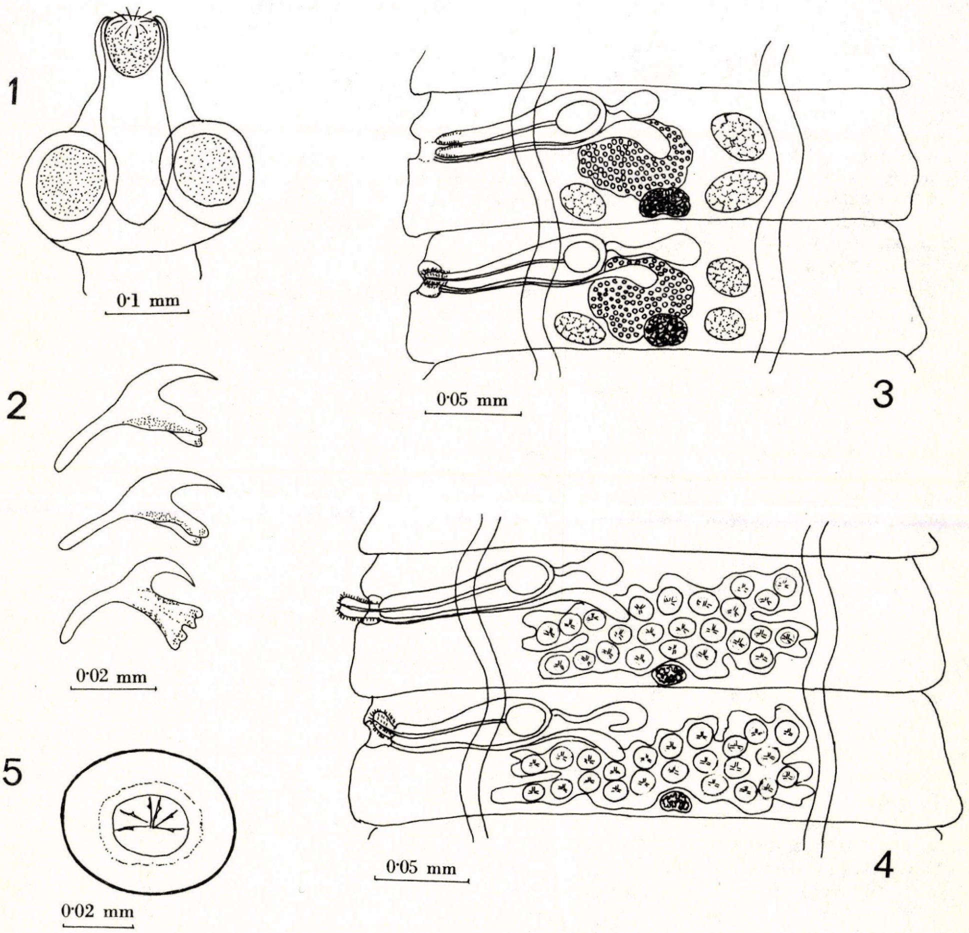
*) The identification number of the cestode specimens are made up of three parts:
- Serial number of parasites in the register-book of the Parasitological Collection of the Hungarian Natural History Museum;
- in parentheses: serial number of host specimens examined;
- individual labels of preparations (number or letters).

23047/C, 2684/23047/D, 2684/23047/2, 2684/23047/5, 2684/23047/6, 2684/23047/7, 2684/23047/8, 2684/23047/9; Lenartov, Večný potok, 11 November, 1981, 1 specimen, No: 2729/23102/5;

Štolické vrchy Mts, Chyžné, 13 September, 1982, leg. MURAI, 15 specimens and scoleces, Nos: 3086/25017/4 (in the MNHG - all the rest in the HNHM), 3086/25017/5, 3086/25017/6, 3086/25017/7a-b, 3086/25017/8, 3086/25017/9, 3086/25017/ C1-2 , 3086/25017/D1-2, 3086/25017/E1-2, 3086/25017/G1-2, 3086/25017/K1-2, 3086/25017/L1-2, 3086/25017/N1-2, 3086/25017/O1-2, 3086/25017/R1-2;



Figs 1-5. Triodontolepis torrentis sp. n.
(1= scolex, 2= hooks, 3= mature segments, 4= gravid segments, 5= egg (orig.)

Slovenský Raj, Stratená, 27 October, 1984, leg. MURAI, 2 specimens, Nos: 4030/33383/A, 4030/33383/C1-2, Mlynky, Havrania dolina, 24 May, 1984, leg. MURAI, 4 specimens, Nos: 3948/32637/2a-b, 3948/32637/3a-b, 3948/32637/4, 3948/32637/5; Mlynky, Havrania dolina, 25 October, 1984, leg. MURAI, 1 specimen, No: 3985/33305/A1-2; 26 October 1984, leg. MURAI, 9 specimens, Nos: 4009/33349/1a-b, 4009/33349/2a-b, 4009/33349/3a-b, 4009/33349/4a-b, 4009/33349/5a-b, 4009/33349/7, 4009/33349/8, 4009/33349/ 9a-b, 4009/33349/11, the last one is deposited in MHNG;

Hungary, Mátra Mts, Mátraalmás, Szuhai patak, in the valley, 27 June, 1984, leg. MÉSZÁROS, 5 specimens, Nos: 10348/1309/B, 10348/1309/K1-2, 10348/1309/P, 10348/1309/30, 10363/1334/A1-3;

Roumania, Gilau Mts, Baisoara valley (altitude 700 m), 11-15 August, 1971, leg. MÉSZÁROS, 26 specimens in 28 preparations, Nos: 4356/118/1, 4356/118/2, 4357/119/1, 4357/119/2, 4357/119/3, 4357/119/4, 4362/124/1, 4364/127/1, 4366/129/1, 4368/131/3, 4369/132/1, 4369/132/2, 4377/146/1, 4377/146/2a-b, 4377/146/3, 4378/147/2, 4378/147/3, 4379/149/1, 4379/149/2, 4379/149/3, 4379/149/4, 4386/157/1, 4378/158/1, 4386/159/2, 4386/159/3, Nos 4368/131/1 and 2 deposited in MNHG;

South Carpathians, Retezat Mts, Gura-Zlata, 13 July, 1971, leg. MÉSZÁROS, 2 specimens in one slide, No: 4414/309/4.

Description (all measurements are in mm): Small hymenolepidid, length of specimens with ripe eggs 12-21, maximum width in postmature segments 0.30-0.35. Number of segments over 200 (240-370). Strobila slightly craspedote. Segments wider than long, the last ones containing ripe eggs measure 0.350x0.165.

Scolex bulbiform, 0.30-0.44 long and 0.28-0.40 in diameter. Four suckers strongly developed, rounded, 0.16-0.19 in diameter. Rostellum musculose, 0.08-0.09 in diameter and 0.07-0.09 long. Ten rostellar hooks in one circle, from bifurca-type, length of hooks 0.038-0.042, basis 0.034-0.037. Length of handle 0.017, of blade 0.019 and of guard 0.019. The tip of the guard-lobe 0.013 wide with a 7 µm deep notch in its middle (Figs 2 and 23-25). Rostellar sac large, 0.22-0.38 x 0.15-0.20. Neck present (0.2-0.5 mm unsegmented area posteriorly to the scolex).

Mature segments 4 fold as wide as high. Three testes in triangle (in strongly contracted specimens in one line), one poral, two aporal, 0.025 x 0.040 large. The cirrus is covered with fine spines, the protruding part 0.015 by 0.035. Cirrus sac 0.080-0.125 x 0.017-0.020 across the line of excretory vessels. Vesicula seminalis interna 0.015 x 0.025, vesicula seminalis externa 0.030-0.050 x 0.025. The slightly lobed ovary lies in the middle field centrally or porally, 0.037-0.050 x 0.050-0.090. Vitelline gland rounded, posterior to ovary, 0.025-0.030 in diameter. The thin-walled vagina opens into the genital atrium posterior to the cirrus sac; near to ovary dilating into a small seminal receptacle. In postmature segments the saccular uterus occupies the whole middle field. Over 20 eggs in one gravid segment, measurements 0.040 x 0.048-0.045 x 0.065; the embryo 0.030-0.037 x 0.020-0.025, length of embryonal hooks 0.010-0.011. Uterus not forming egg capsules (Figs 1-5 and 22-28).

Measurements of the holotype specimen (HNHM No: 1914/16827/1) ex Neomys fodiens: Length of the strobila 21, maximum width 0.330. Number of segments 370 (juvenile 70, premature 40, mature 160, postmature 60, gravid segments with juvenile eggs 10, with ripe eggs 30).

Length of scolex 0.400, width 0.330. Diameter of suckers 0.16-0.17. Rostellum 0.08 wide and 0.09 in length, with 10 hooks of bifurca-type, 0.040 in length and 0.036 of the basis. Rostellar sac 0.300 x 0.200.

Testes in triangle, one poral and two aporal, 0.040 x 0.025 in size. Cirrus with fine spines, cirrus sac 0.095-0.12 x 0.020, vesicula seminalis interna 0.030 x 0.015, vesicula seminalis externa 0.050x0.027. Vagina thin-walled, forming a seminal receptacle, 0.100 x 0.015 in size. Ovary in middle field poral or central. Vitelline gland central and posterior to the ovary, 0.025 x 0.015. Uterus saccular, 0.320 x 0.165, with 25-30 ripe eggs, not forming egg capsules. Eggs ovoid, 0.065 x 0.045, the embryo 0.037 x 0.022, embryonal hooklets 0.011 long.

The name of the species was chosen torrentis as this species has exclusively been collected in northernly valleys of streams between 700 and 1000m altitude. The intermediate host of the species is probably a Gammarus species living in these streams.

Differential diagnosis: T. torrentis sp. n. differentiated well from the other Triodontolepis species:

by the number and measurements of rostellar hooks,

by the absence of egg capsules (see the identification key).

Triodontolepis bifurca (Hamann, 1891) (Figs 10-15).

Hosts: Neomys fodiens and N. anomalus. - Localization: small intestine. - Intensity: 1-5 specimens. - Extensity: 6 %.

Material examined: 37 specimens from 12 N. fodiens and 1 N. anomalus in ten localities were found.

Host: N. fodiens:

Slovakia, Polana Mts, 12 September, 1978, leg. DUDICH, 1 specimen;

Nizke Tatry Mts, Staré Hory, Rychtarová dolina, 11 May, 1979, leg. DUDICH, 5 specimens; Nizke Tatry Mts, Jarabá, 20 September, 1983, leg. MURAI, 12 specimens;

Vel'ka Fatra Mts, Harmanec, Bystrická dolina, 28 August, 1979, leg. DUDICH, 3 specimens in 4 slides;

Čergov Mts, Lenartov, Večný potok, 10-11 November, 1981, leg. MURAI, 2 specimens;

Štolické vrchy Mts, Chyžné, 13 September, 1982, leg. MURAI, 6 specimens in 9 slides;

Slovenský Raj, Novoveská Huta, 25 October, 1984, leg. MURAI, 3 specimens in 5 slides; Slovenský Raj, Mlinky, Havrania dolina, 26 October, 1984, leg. MURAI, 4 specimens in 6 slides;

Hungary, Kisbalaton, 10 December, 1964, leg. EDELÉNYI, 1 specimen in 3 slides (identified by EDELÉNYI as Vampirolepis tridontophora).

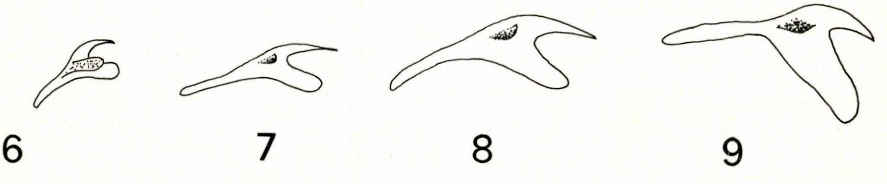
Host: Neomys anomalus:

Hungary, Pilis Mts, Pilisborosjenő, 22 August, 1971, leg. HAAS, 1 specimen.

Morphological and metrical characters of T. bifurca

Length of strobila 12-22 mm, maximum width 0.5, number of segments 320-370, of which 60-75 containing egg capsules (1 in each segment). Scolex diameter 0.40-0.56, length 0.3-0.5. Rostellum 0.12-0.16 x 0.10-0.13, with 10 strong rostellar hooks. Hooks measure 0.068-0.078 in the Carpathians and 0.061-0.069 in Hungarian localities (two cases only); basis of rostellar hooks 0.056-0.065 (0.052-0.058 in the latter two cases). Handle and blade both 0.035-0.038, length of guard 0.035. The tip of the guard-lobe 0.020-0.022 wide and in the centre of the tip a 10 µm deep notch (Figs 10-11). Diameter of suckers 0.18-0.25, rostellar sac 0.22-0.36 x 0.15-0.25.

Testes in one line, two aporal, one poral. Cirrus sac 0.09-0.010 x 0.020, cirrus spinose, vesicula seminalis interna and externa present. A small ovary in the centre of middle field, vitelline gland posterior to it. Uterus saccular, forming egg capsule 0.126-0.160 x 0.180-0.200, the chitinous wall of the capsule 5 µm thick. The eggs in the uterus measure 0.050 x 0.035, the embryo 0.027-0.035 x 0.020-0.027, length of the embryonal hooks 0.011-0.012.



Figs 6-9. Rostellar hooks of Vampirolepis species from bats (6= V. miniopteri (Sandars, 1957), after the orig. description, 7= V. baeri Murai, 1976, orig., 8= V. acuta (Rudolphi, 1819), orig., 9= Hymenolepis phyllostomi Vaucher, 1982, after the orig. description)

Triodontolepis hamanni (Mrázek, 1891) (Figs 16-21).

Hosts: Neomys fodiens and N. anomalus. - Extensity: 7.5%. - Intensity: 1-50 specimens (or more).

Material examined: 133 T. hamanni specimens from 25 host specimens in 15 localities.

Host: Neomys fodiens:

Slovakia, Kremnické vrchy Mts, Turček, 15 July, 1975, leg. DUDICH, 4 specimens;

Vel'ká Fatra Mts, Harmanec, Bystrická dolina, 28 August, 1979, leg. DUDICH, 33 specimens; Vel'ka Fatra Mts, Lubochnianska dolina, 14 August, 1980, leg. MURAI, 2 specimens;

Polana Mts, 21 September, 1978, leg. DUDICH, 6 specimens;

Nizke Tatry Mts, Jarabá, 21 September, 1983, leg. MURAI, 13 specimens;

Západné Tatry, Vychodná, 29 May, 1984, leg. MURAI, 2 specimens;

Nizke Beskidy Mts, Becherov, 13 September, 1979, leg. DUDICH and MURAI, 1 specimen;

Čergov Mts, Lenartov, Večný potok, 10 November, 1981, leg. MÉSZÁROS and MURAI, 4 specimens;

Slovenský Raj, Mlynky, Havrania dolina, 22-24 May, 1984, leg. MÉSZÁROS, 7 specimens; Slovenský Raj, Stratená, 28 October, 1984, leg. MÉSZÁROS, 2 specimens;

Štolické vrchy Mts, Chyžné, 13 September, 1982, leg. MURAI, 16 specimens, Štolické vrchy Mts, Zdychava, 22 July, 1980, leg. MÉSZÁROS, 1 specimen;

Hungary, Mátra Mts, Mátraalmás, Szuhai patak (in the valley), 26-27 June, 1984, leg. MÉSZÁROS, 38 specimens; Mátra Mts, Rudolf-tanya, 14 October, 1983, leg. MÉSZÁROS, 1 specimen.

Host: N. anomalus:

Bakony Mts, Németbánya, Vadász valley, 11 August, 1973, leg. MURAI, 2 specimens; Bakony Mts, Németbánya, montane bog, 25 October, 1979, leg. MURAI, 1 specimen.

Characterization of T. hamanni:

VAUCHER (1971) described very well the morphology of T. hamanni (Mrázek, 1891) synonym Hymenolepis hamanni (Mrázek, 1891). In the following we present the metric and morphological data of our material:

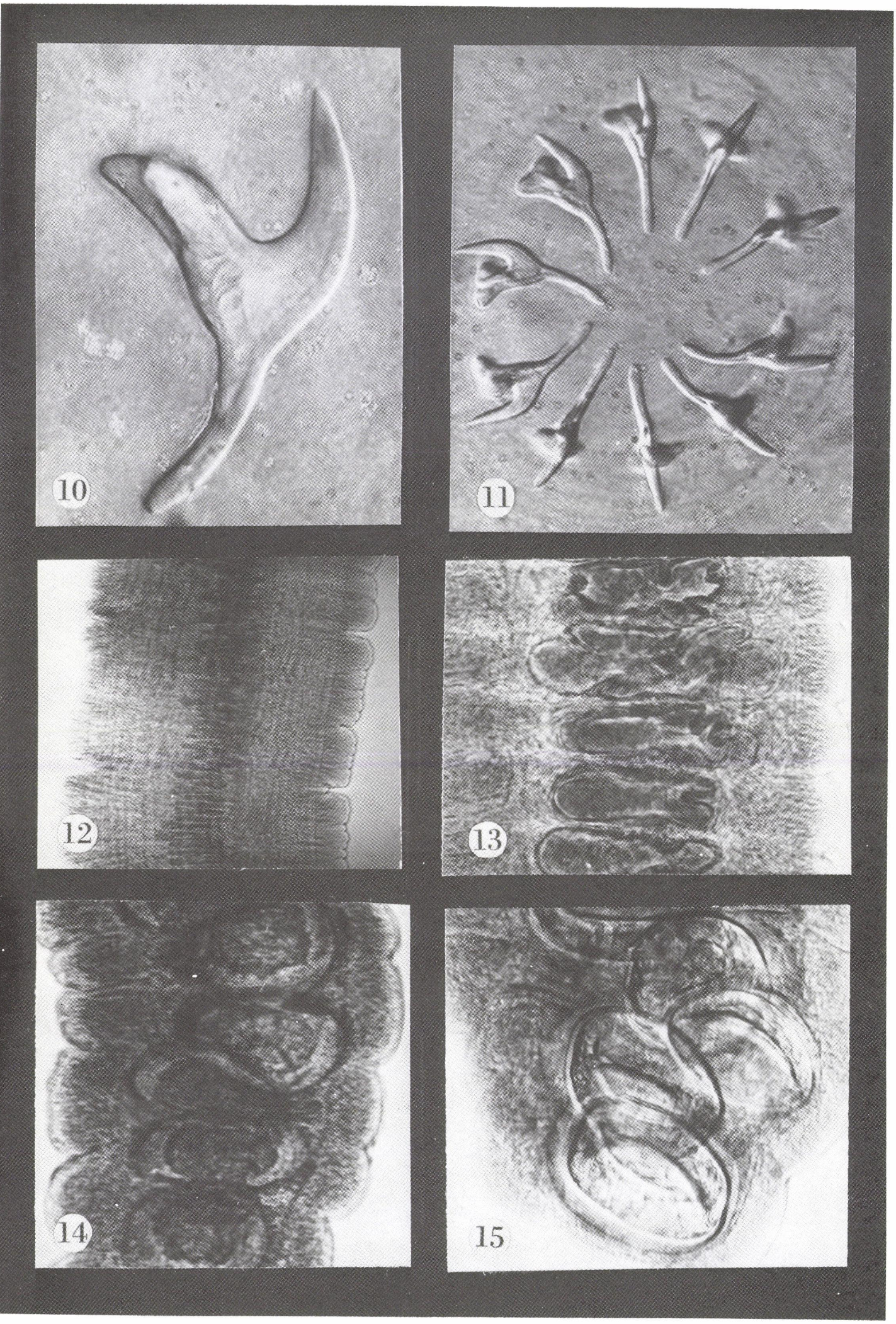
Small hymenolepidid. Number of segments 200-270. Length of the strobila (with ripe egg capsule) 7-15, maximum width in postmature proglottids 0.32. Scolex diameter 0.245-0.320, length 0.280-0.400. Rostellum 0.050-0.070 by 0.070-0.090, rostellar sac 0.160-0.300 x 0.080-0.130. Diameter of suckers 0.090-0.150. Number of hooks 16-21 (in 40 scolex examined the number of hooks are 16 in 3 cases, 17 in 12 cases, 18 in 12 cases, 19 in 7 cases, 20 in 5 cases and 21 in one case). Form of rostellar hooks of bifurca-type: Length of the hooks varying between 0.025 and 0.030 (from 40 hooks 9 cases 0.025, 8 cases 0.026, 18

Figs 10-15. Triodontolepis bifurca (Hamann, 1891)
(10= character of the hook "bifurca type", 11= hook crown of T. bifurca, 12= mature segments, 13= postmature segments, 14= developing of egg capsules surrounding the eggs, 15= egg capsules in the last segments)

Figs 16-21. Triodontolepis hamanni (Mrázek, 1891)
(16= whole hook crown of T. hamanni, 17= form of the rostellar hooks, 18= postmature segments, 19= eggs in saccular uterus, 20= developing egg capsules, 21= ripe egg capsules)

Figs 22-28. Triodontolepis torrentis sp. n.
(22= scolex, 23= form of one rostellar hook, 24= hooks in various position, 25= whole hook crown, 26= mature segments, 27= postmature segments, 28= eggs freely in the last segments)

Figs 29-33. Triodontolepis skrjabini Spassky et Andrejko, 1968
(29= form of the rostellar hooks, 30= whole hook crown, 31= mature segments, 32,34= eggs in the saccular uterus, 33= ripe egg capsules. - Figs 10, 11, 16, 17, 23, 24, 25, 29 and 30 Photo LOVAS, all photographs made of the study material)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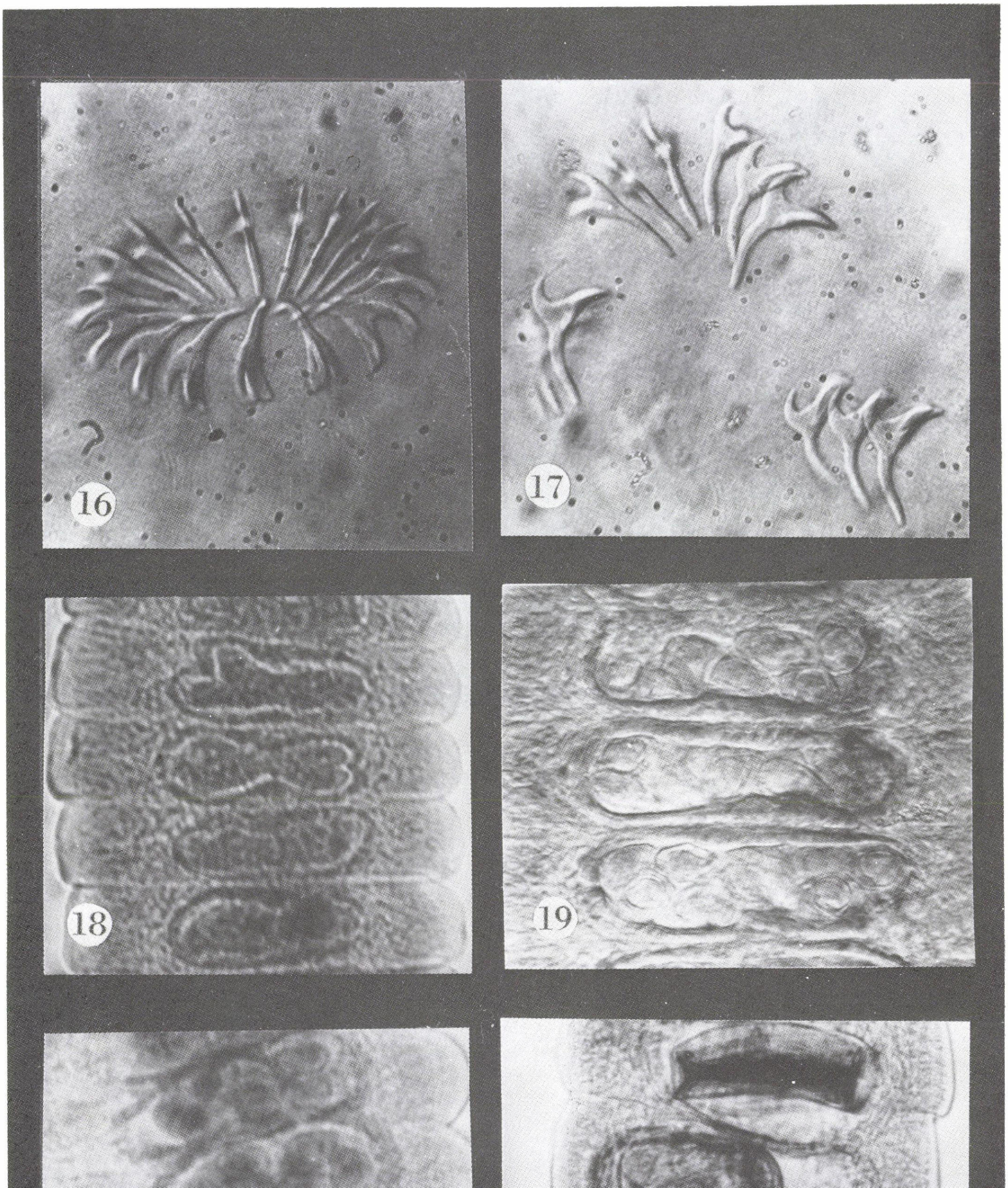
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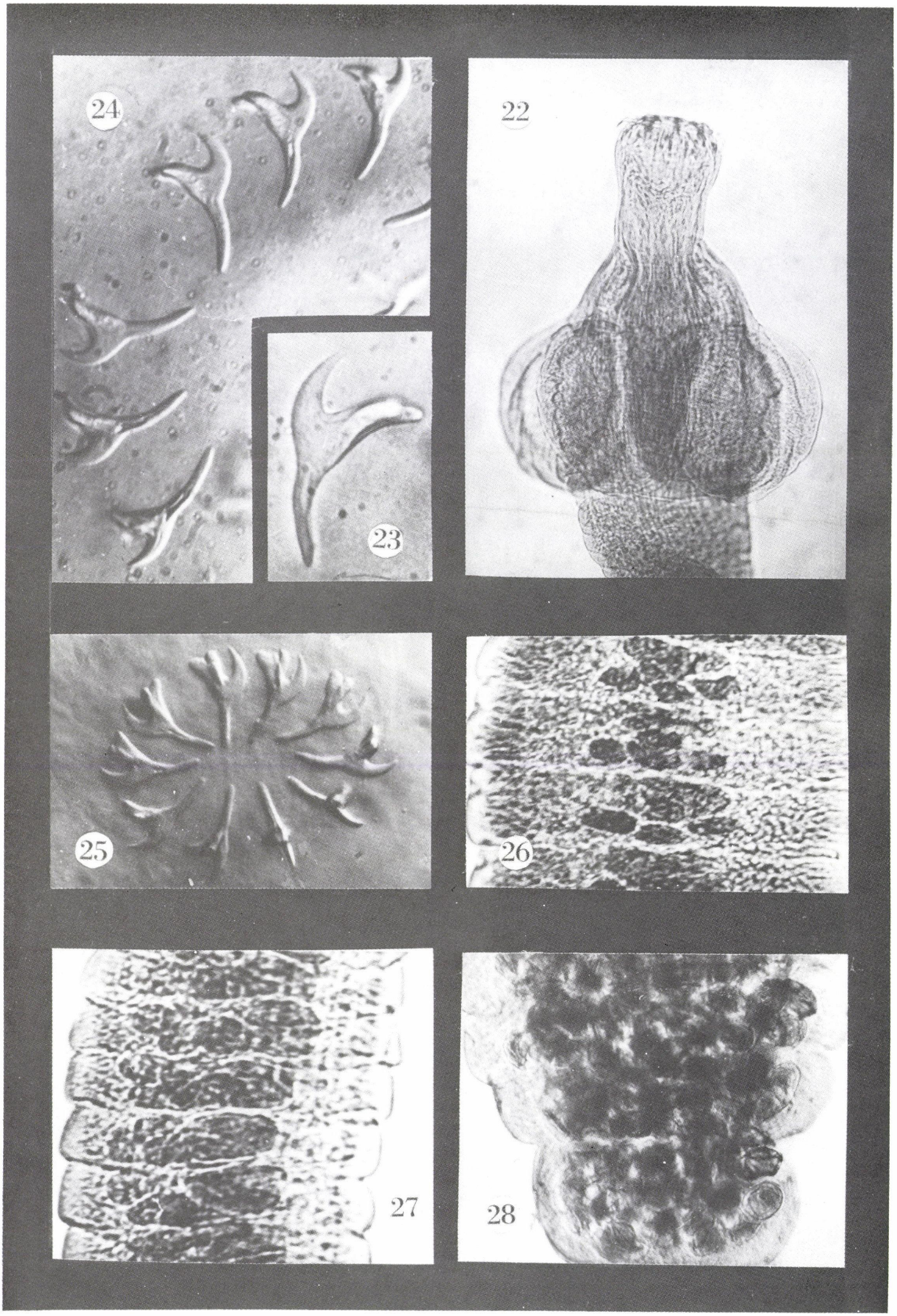
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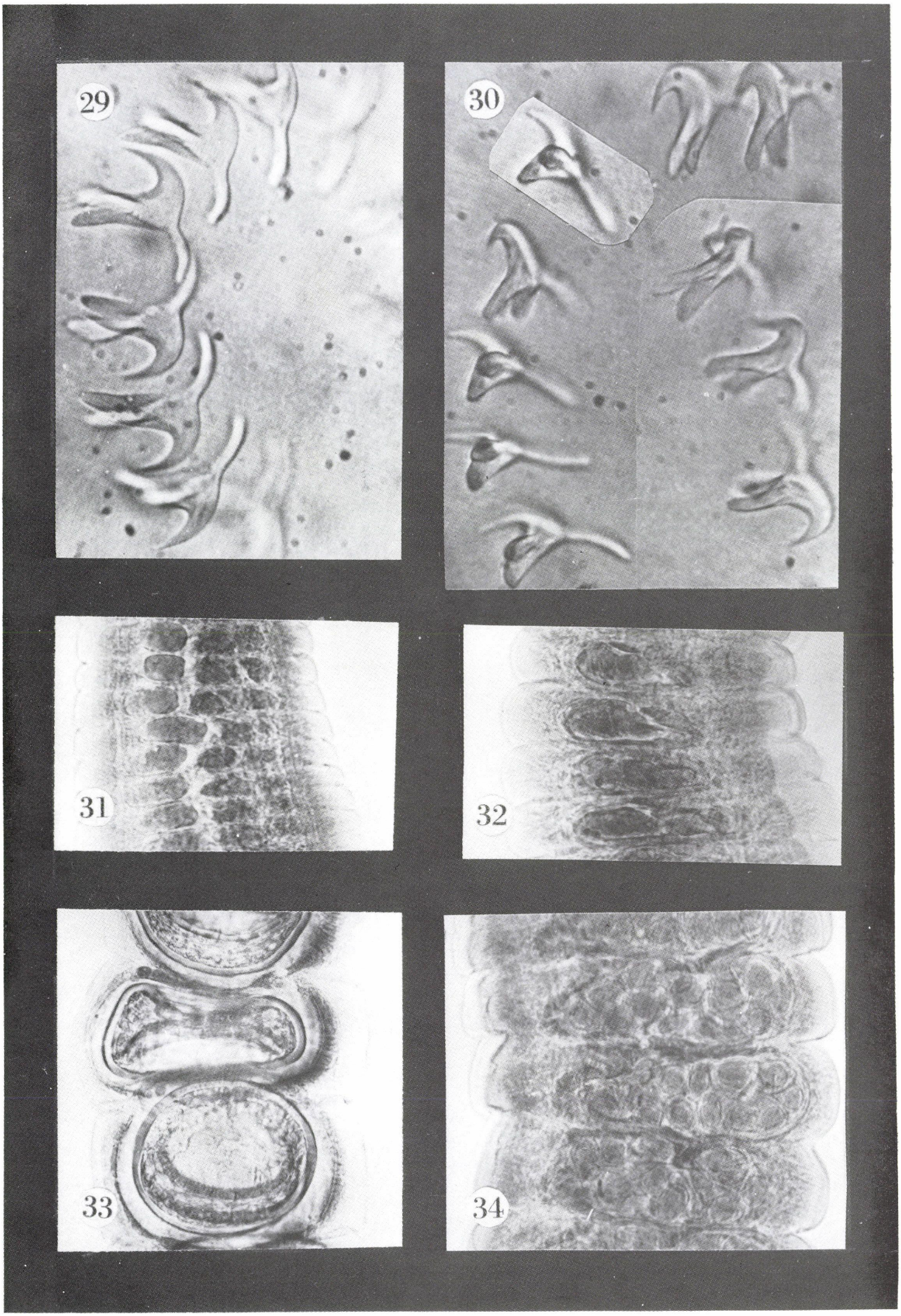
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cases 0.027, 4 cases 0.029 and one case 0.030); basis of hooks 0.022-0.027 (one case 0.022, one 0.023, 4 cases 0.024, 23 cases 0.025, 8 cases 0.026 and 3 cases 0.027 mm). The handle and the balade as well as the guard are of the same length (0.012-0.013), the tip of the guard-lobe 0.005-0.007 wide and there is a small there is a small 3 µm deep notch in its middle (Figs 16-17).

Testes in triangle or in one line, two aporal and one poral. Cirrus finelly spinose, cirrus sac 0.07-0.10 x 0.02, vesicula seminalis interna 0.015 by 0.010, a little vesicula seminalis externa present. Ovary in poral side 0.06 x 0.012, vitelline gland 0.025 in diameter. The thin-walled vagina widens to form a small seminal receptacle. Uterus saccular, containing over 20 (40) eggs, and forming an egg capsule (1 in each segment) 0.11-0.14 x 0.16-0.18, the wall of capsules in 5 µm thick. Eggs measure 0.044 x 0.031, the embryo 0.020 x 0.030, the embryonal hooks are 0.010 long.

Triodontolepis skrjabini Spassky et Andrejko, 1968 (Figs 29-34).

Hosts: Neomys fodiens and N. anomalus. - Localization: small intestine. - Intensity: 1-10 specimens. - Extensity: 6 %.

Material examined: 34 specimens from 9 N. fodiens and 5 N. anomalus in seven localities were found.

Host: Neomys fodiens:

Slovakia, Čergov Mts, Lenartov, Večný potok, 10 November, 1981, leg. MURAI, 1 specimen;

Štolické vrchy Mts, Chyžné, 13 November, 1982, leg. MURAI, 1 specimen;

Vel'ka Fatra Mts, Harmanec, Bystrická dolina, 28 August 1979, leg. DUDICH, 2 specimens;

Hungary, Mátra Mts, Mátraalmás, Szuhai patak (valley), 27 June, 1984, leg. MÉSZÁROS, 22 specimens;

Roumania, Gilau Mts, Baisoara valley, 11-15 August, 1971, leg. MÉSZÁROS, 3 specimens.

Host: Neomys anomalus:

Hungary, Bükk Mts, Nagyvisnyó, Bán patak(in the valley), 15-16 October, 1983, leg. MÉSZÁROS, 3 specimens;

Börzsöny Mts, Királyháza, 9 October, 1983, 2 specimens, leg. MÉSZÁROS.

Metric and morphological data of T. skrjabini based on our material:

Small hymenolepidid species. Mature specimens 10-15 long, 0..3 wide. Number of segments 200-300 (of 272 segments 32 were found to contain mature egg capsule), always wider than high. Diameter of scolex 0.220-0.370, length 0.200-0.330. Diameter of the four suckers 0.085-0.120. Diameter of the muscular rostellum 0.06-0.08, height 0.05-0.07, the rostellar sac 0.250 x 0.150. There are 10 (in 1 case 11) hooks of bifurca-type on the rostellum, 0.025-0.027 long, basis 0.022-0.025, handle 0.012, blade 0.013, guard 0.012-0.013 long, the tip of the guard-lobe 0.010 wide, and there is a 6 µm deep notch in its middle (Figs 29-30).

Strobila slightly craspedot. The series of segments of various degrees of maturity clearly distinguishable. In mature segments the 3 testes arranged in a triangle, in strongly contracted strobila along a line. One testis porally, the other two aporally situated, 0.025 x x 0.050 large. The ovary is situated centrally or porally beneath the vitelline gland. The cirrus sac 0.080 x 0.020, there is a vesicula seminalis interna and externa. Cirrus finelly spinose. The thin-walled vagina opens behind the cirrus and there is a seminal receptacle. In postmature segments the uterus occupies the whole central field, surrounding the eggs in an egg shape and when in the eggs the embryonal hooks appear, this formation turns into a strongly chitinized capsule (Figs 32-34). Egg capsule 0.100 x 0.170 - 0.160 x 230 in size, the thickness of the wall 3 µm. The eggs in the uterus (ca. 20 per segment) measure 0.044 x x 0.035, the embryo 0.023-0.027 x 0.017-0.019, length of the embryonal hooks 0.009.

Note. The species has not been reported from elsewhere than its type locality (Moldavia, SPASSKY and ANDREJKO, 1968). We now have evidence for its occurrence from the Gilau Mts and in the west in the Börzsöny Mts, and in the north to Lenartov (Čergov Mts).

IDENTIFICATION KEY TO THE GENUS TRIODONTOLEPIS YAMAGUTI, 1959

1 (10) Number of rostellar hooks 10 (exceptionally 11-12)

2 (3) Ripe eggs in the last segments without egg capsule, length of the hooks 38-42 µm, at the basis 34-37 µm, host: Neomys fodiens .... T. torrentis sp. n.

3 (2) Eggs in capsule-like formations

4 (5) Length of hooks 25-27 µm, at the basis 22-25 µm, hosts: N. anomalus and N. fodiens .... T. skrjabini Spassky et Andrejko, 1968

5 (4) Length of hooks over 50 µm

6 (9) Number of hooks 10

7 (8) Length of hooks over 60 µm (see variability in footnote)* .... T. bifurca (Hamann, 1891)

8 (7) Length of hooks less than 60 µm (after VAUCHER, (1971) syn. of T. bifurca) .... T. tridontophora (Soltys, 1954)

9 (6) Number of hooks 10-12, length 80 µm (after VALKOUNOVÁ, 1985) 72-76 µm), basis 68 µm, host: N. anomalus, in Sumava Mts (after VAUCHER (1971) syn. of T. bifurca) .... T. sumavensis (Prokopič,1957)

10 (1) Number of rostellar hooks over 15

11 (12) Number of hooks 16-18, length 21-24 µm, basis 19 µm .... T. neomidis (Baer, 1931)

12 (11) Number of hooks 16-21, length over 25 µm (see variability in footnote)** .... T. hamanni (Mrázek, 1891)

13 (14) Number of hooks 30, length 28 µm, basis 26 µm, handle longer than blade, host: N. anomalus .... T. rysavyi Prokopič, 1972

14 (13) Number of hooks 34, length 30-32 µm, basis 30 µm, handle shorter than blade, host: N. fodiens, Georgian SSR .... T. kurashvilii Prokopič et Matsaberidze, 1971

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* There are some opinions and observations about the variability of the species T. bifurca; all have 10 rostellar hooks with the same characteristic form:

- a - Length of hooks 65 µm, basis 61 µm (adults) and 65 µm by 60 µm (cysticercoids), Switzerland VAUCHER,1971
- b - Length of hooks 61-69 µm, basis 52-58 µm, hosts: N. anomalus and N. fodiens, Hungarian localities .... present paper
- c - Length of hooks 67-78 µm, basis 56-65 µm, host: N. fodiens, West Carpathians .... present paper
- d - Length of hooks 68 µm, basis 64 µm, host: N. fodiens, Bulgaria ...... GENOV, 1984
- e - Length of hooks 60-64 µm, basis 45-47 µm, adult worms and cysticercoids, in Czech Basin .... PROKOPIČ, 1972 and VALKOUNOVÁ, 1985

**Measurements of T. hamanni by various authors:

- a - 18-22 hooks, length 25 µm (cysticercoids) .... LINSTOW, 1982
- b - 15-22 hooks, 23-33 µm long (cysticercoids, probably mixed data of T. neomidis and T. hamanni) .... BAER and JOYEUX, 1943
- c - 16-17 hooks, 23-26 µm long (adults) VAUCHER,1971
- d - 15-20 hooks, 26-31 µm long (cysticercoids) .... VALKOUNOVÁ, 1985
- e - 16-20 (in one case 21) hooks, 25-29 µm long (adults), host: N. fodiens, West Carpathians .... present paper
- f - 16-18 hooks, 19-24 µm long (adults), host: N. fodiens, Bulgaria (syn. of T. neomidis Baer, 1931) .... GENOV, 1984

DISCUSSION

YAMAGUTI (1959) gave the shape of the hooks as the most important character in the diagnosis of the genus Triodontolepis: "Rostellar hooks 10 or more, Y-shaped in profile: guard bifurcate, nearly as long as, or longer than blade; handle as long as, or longer than blade."

PROKOPIČ (1972, p. 283) amended this description by his following observations: "... we observed on the hooks of members of the genus Triodontolepis that the guard is not bifurcated and that bifurcation is mimicked by a thickening of both sides of the guard which, however, are connected by a distally undulated membrane. Through this thickening a groove of varying depth is formed in the centre of guard."

The shape of the hooks of Hymenolepis bifurca (Hamann, 1891) - bifurca-type - is well-known in the literature. According to PROKOPIČ (1972) the "bifurcate" adjective does not necessarily mean that the tip of the guard branches into two. I have observed, however, that there is a notch of variable depth on the tip of the guard-lobe (Figs 2, 10-11, 17, 23, 24, 29). The shape of the hooks of T. bifurca, T. hamanni, T. neomidis, T. skrjabini, T. sumavensis (a probable synonym of T. bifurca), T. kurashvilii, T. rysavyi and the new species T. torrentis sp. n. is all in accordance with this finding.

PROKOPIČ (1972) proposed that the description of the genus be amended by the criterium that in the uterus "the presence of capsule-shaped formations covering the eggs" is a generic feature of the genus. PROKOPIČ also noted that this feature, the formation of "egg cocon" after SPASSKY and ANDREJKO (1969) is also found in other hymenolepidid genera, e.g. in Coronacanthus and Insectivorolepis.

The genus is homogeneous as regards the shape of the hooks, the new species differs from the others as regards the formation of egg cocons, as T. torrentis sp. n. does not form egg capsules, the mature eggs are freely distributed in the uterus of the gravid segment (Fig. 28).

The Triodontolepis species are generally small (adults measure 8-20 mm x 0.3-0.4 mm in various host species), the shape and the size of the scolex are very similar and since several species may coexist in a given host, it is very difficult to separate the various species. The onion-shaped scoleces of Triodontolepis may be distinguished from the sympatric bowl-shaped scoleces of the Coronacanthus species. In a single host (Neomys fodiens, Chyžné, No. 3086/25017) among the 40 mounted specimens there were 15 T. torrentis sp. n., 16 T. hamanni, 1 T. skrjabini, 6 T. bifurca and 2 Coronacanthus integrus (Hamann, 1891). The features of the species, the size of their organs and the shape and size of the egg cocons are very similar. Members of the T. bifurca group have wider and stronger scoleces and rostella which are visible even with the aid of low magnification of stereo microscope. T. torrentis sp. n. may be recognized by the freely distributed mature eggs in the last segments.

Useful characters for identifying Triodontolepis species are the number and size of the hooks and the slighter morphological differences among the various species. There may be slight variation in the number of hooks among the various species: e.g. in T. sumavensis of the T. bifurca species group there are 12 hooks instead of 10, among the T. skrjabini specimens examined by me there was one with 11 hooks instead of 10, and the number of hooks in T. hamanni varied between 16 and 20 (with one case of 21). It is worth taking into consideration the total length and the lengths of the basis (from the tip of the handle to the outer edge of the guard), the handle, the blade, and the width of the lobe of the guard and the depth of the notch in the middle of the lamella of the guard. On the basis of this it is possible to separate e.g. the hooks of T. hamanni from those of T. skrjabini:

	T. hamanni	T. skrjabini
No. of hooks	16-20	10 (11)
Total length	27-30 µm	25-26 (27) µm
Basis	25-27 µm	22-25 (27) µm
Width of guard-lobe	5.5-5.6 µm	8-10 µm
Bifurcation	3 µm	6 µm

Of the species closely allied to T. hamanni, PROKOPIČ and MATSABERIDZE (1971) characterized T. kurashvilii by hooks with strikingly short handle and PROKOPIČ (1972) described T. rysavyi as having unusually long handle.

BAER (1932) characterized Hymenolepis neomidis (Baer, 1931) from Neomys fodiens captured in the environs of Geneva, with 18 rostellar hooks 22 µm long, and the form was depicted as having a strong guard with a little bifurcation on the tip. This species was regarded by JOYEUX and BAER (1952) as a synonym of H. hamanni (Mrázek, 1891). BAER examined tapeworms of Neomys fodiens and the cysticercoids of hymenolepidids in two localities in Switzerland (Geneva and St. Blaise aff. Neuchâtel). He observed scoleces with rostellar hooks measuring about 20 µm (Geneva) and with hooks about 30 µm in length too (Neuchâtel). It is possible that the population in the environs of Geneva (type locality of H. neomidis) belongs to the form inhabiting the Balkan Peninsula (16-18 hooks, 21-24 µm long and 19 µm at the basis (T. hamanni sensu GENOV, 1984), in which case the name H. neomidis Baer, 1931 is valid and the species should be included in the genus Triodontolepis Yamaguti, 1959, as Triodontolepis neomidis (Baer, 1931) comb. n.

YAMAGUTI referred Hymenolepis miniopteri Sandars, 1957 to the genus Triodontolepis. This species is a parasite of Australian bats and the shape of its hooks is unlike the bifurcate type of Triodontolepis. In H. miniopteri it is not the lobe of the guard which is bifurcate but at the junction of the handle and the blade on both sides there is a pronounced extrusion which SANDARS considered a specific character: "There are 20-25 rostellar hooks which are 14-16 µm long and with a very characteristic shape, having an accessory lateral flange to the unusual hymenolepidid rostellar hook. This flange is near the junction of the blade with the base of each hook" (see Fig. 6, after SANDARS' 1957).

SPASSKY and ANDREJKO (1969) considered this species as a member of the genus Vampirolepis Spassky, 1954. My own observations substantiate this notion: in Vampirolepis species infesting Hungarian bats (e. g. V. acuta /Rudolphi,1819/, V. baeri Murai, 1976) there is laterally a small lobe on either side of the base of the guard which is 4-6 µm long and ca. 2 µm high, analogous with the "lateral flange" of SANDARS.

The same morphology of hooks was presented by VAUCHER (1982): Hymenolepis elongatus (Rego, 1962) and H. phyllostomi Vaucher, 1982, parasites of South American bats, both have a small lobe on the side of blade (see Figs 7-9). It is not the presence but the size of this character by V. miniopteri which is extraordinary in members of this genus. Therefore V. miniopteri Sandars, 1957 should not be included in the genus Triodontolepis.

Members of the genus Triodontolepis have not been reported from rodents and in fact their occurrence in other insectivore genera has not been reliably documented. Hence, members of the genus Triodontolepis are considered specific parasites of Neomys species.

LIFE CYCLE

Intermediate hosts of Triodontolepis species are freshwater shrimps, Gammarus (Rivulogammarus) pulex (Linné, 1758) and related species.

T. hamanni (as Cysticercus hamanni was based by MRÁZEK (1891) on cysticercoids from G. pulex and characterised by 18-22 rostellar hooks each 30 µm long. This species was revised and redescribed by LINSTOW (1892) and the correct measurements of the hooks were given as 25 µm, both authors qualified the shape of hooks as "bifurca-type". BAER and JOYEUX (1943), JOYEUX and BAER (1936, 1952), PROKOPIČ and GROSCHAFT (1961), VAUCHER and HUNKELER (1967), VALKOUNOVÁ (1985) recorded the larval form of T. hamanni in Gammarus spp., all came to the same conclusion as to the shape and measurements of the rostellar hooks.

Cysticercoids of T. bifurca (Hamann, 1891) were described as Cysticercus Taeniae bifurcae, reported by HAMANN (1891) and LINSTOW (1892) as having 10 hooks measuring 65 µm in length from the intermediate host Gammarus pulex. BAER and JOYEUX (1943), JOYEUX and BAER (1952), VAUCHER and HUNKELER (1967), PROKOPIČ and GROSCHAFT (1961) were of the same opinion.

VALKOUNOVÁ (1985) examined cysticercoids of T. sumavensis Prokopič, 1957 and of T. bifurca (Hamann, 1891) and gave the differences between the rostellar hooks of the two species: according to her paper in T. bifurca 10 hooks measured 47-64 µm, and in T. sumavensis 10 hooks measured 72-76 µm in length. She collected the cysticercoids from Gammarus (R.) fossarum Koch, 1853 (syn. of G. pulex) in the territory of the source of the Vltava and in the Sumava Mts.

SPASSKY and ANDREJKO (1968) found the cysticercoids of T. skrjabini in Moldavian Gammarus specimens. In the case of T. kurashvilii Prokopič et Matsaberidze, 1971 the life cycle in gammarids and the development in experimentally infected white mice were documented (MATSABERIDZE, PROKOPIČ and ZARKUA, 1986). Both cysticercoids have rostellar hooks identical with the adult worms.

GEOGRAPHICAL DISTRIBUTION OF TRIODONTOLEPIS SPECIES

VAUCHER (1971) summarized the records of geographical distribution of tapeworms parasitizing Neomys species. Since his paper (considered only the literature data up to 1969) new findings have been presented by SPASSKY and ANDREJKO (1968), PROKOPIČ (1972), PROKOPIČ and MATSABERIDZE (1972), MURAI, MÉSZÁROS and ŠTOLLMANN (1983), MURAI and MÉSZÁROS (1984), GENOV (1984), VALKOUNOVÁ (1985), MATSABERIDZE, PROKOPIČ and ZARKUA (1986). According to the above references the geographical range of various Triodontolepis species [former Hymenolepis, transferred by YAMAGUTI (1959), SPASSKY and ANDREJKO (1969), PROKOPIČ (1972) and by the author in the genus Triodontolepis Yamaguti, 1959, or originally described in the above mentioned genus] are as follows:

T. bifurca (Hamann, 1891): Pyrenees Mts, Massif Central in France, Jura Mts, Harz Mts, many localities in the Alps, Sumava Mts, Bohemian and Moravian Mts, Bialowieza National Park in Polen, West Carpathians from Biely Carpath to the Čergov Mts, South Slovakia and Slovenský Raj; Bakony Mts, Pilis Mts and Kisbalaton in Hungary; Stara Planina, Vitosa, Lozenska Planina in Bulgaria; South-West Caucasus (Georgian SSR).

T. hamanni (Mrázek, 1891): Massif Central in France, Jura Mts, Garmisch-Partenkirchen, Erlangen, Göttingen, Bohemian and Moravian Mountains, as well as a lot of localities were recorded in West Carpathians. Our records in the North-Central Mountains of Hungary (Börzsöny, Mátra, Bükk Mts) and from the Bakony Mts are in close vicinity of the localities in Slovakia. MATSABERIDZE and PROKOPIČ recorded these species from the Georgian SSR. The findings from the Balkan Peninsula (GENOV, 1984) may be T. neomidis (Baer, 1931).

T. skrjabini Spassky et Andrejko, 1968 was first recorded from Moldavian SSR and with our material its range is supplemented by localities in the Carpathian Basin: Gilau Mts (Roumania); Börzsöny Mts, Mátra Mts and Bükk Mts (Hungary); Chyžné in Štolické Vrchy and the Čergov Mts (Slovakia).

T. neomidis (Baer, 1931) comb. n. found in environs of Geneva and in the Balkan Peninsula.

T. rysavyi Prokopič, 1972 is known only from the type locality: Lidice in Czechoslovakia.

T. kurashvilii Prokopič et Matsaberidze, 1972: This species were described and now in cysticercoid stadium found in the Likhet Mts (Georgian SSR).

T. torrentis sp. n. known only from the Carpathian Basin (see present paper).

SUMMARY

An examination of Triodontolepis Yamaguti, 1959 material from Neomys fodiens and N. anomalus in the Carpathian Basin resulted in the occurrence of four species: Triodontolepis bifurca (Hamann, 1891), T. hamanni (Mrázek, 1891), T. skrjabini Spassky and Andrejko, 1968 and T. torrentis sp. n.

As regards the morphology of Triodontolepis species, the most important characteristic is still the form of the rostellar hooks - "bifurca-type" - and the hosts, Neomys species. According to these fundamental principles, we propose Hymenolepis miniopteri Sandars, 1957 to be arranged in the genus Vampirolepis Spassky, 1954.

Species composition of Triodontolepis:

T. bifurca (Hamann, 1891), syn. Taenia bifurca Hamann, 1891; Hymenolepis bifurca (Hamann, 1891) in BAER et JOYEUX (1943, 1952), VAUCHER (1971); Hymenolepis tridontophora Soltys, 1954, Vampirolepis tridontophora (Soltys, 1954) in PROKOPIČ, 1957, EDELÉNYI, 1966; Triodontolepis tridontophora (Soltys, 1954) in YAMAGUTI, 1959 as type species of the above mentioned genus.

T. hamanni (Mrázek, 1891), syn.: Cysticercus hamanni Mrázek, 1891; Cysticercus Taeniae hamanni Mrázek in LINSTOW, 1892; Dicranotaenia neomydis (Baer, 1931) in LÓPEZ-NEYRA, 1942; Hymenolepis hamanni (Mrázek, 1891) in BAER and JOYEUX, 1943 and VAUCHER, 1971; Vampirolepis hamanni (Mrázek, 1891) in PROKOPIČ and GROSCHAFT, 1961; Vampirolepis neomydis (Baer, 1931) in MITUCH, 1964, PROKOPIČ, 1957 and 1959.

T. sumavensis (Prokopič, 1957), syn.: Vampirolepis sumavensis Prokopič, 1957, the species after VAUCHER, 1971 is syn. of T. bifurca (Hamann, 1891).

T. skrjabini Spassky et Andrejko, 1968.

T. kurashvilii Prokopič et Matsaberidze, 1971.

T. rysavyi Prokopič, 1972.

T. neomidis (Baer, 1931) comb. n., synonyms: Hymenolepis neomidis Baer, 1931 and Vampirolepis hamanni (Mrázek, 1891) in GENOV, 1984.

T. torrentis sp. n., syn.: Hymenolepis montana Murai, 1984 in MURAI and MÉSZÁROS, 1984, MÉSZÁROS and ŠTOLLMANN, 1984 (in litteris name); Hymenolepis neomydis Baer, 1931, in MURAI, MÉSZÁROS and ŠTOLLMANN, 1983 (taxonomic error).

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Author's address: Dr. Éva MURAI
Zoological Department
Hungarian Natural History Museum
Baross utca 13.
H-1088 Budapest
HUNGARY